

INSTITUTE FOR ASTRONOMY
UNIVERSITY OF HAWAII
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Washington, D. C. 20546

Attention: (Miss) Winnie M. Morgan
Technical Reports Officer

Subject: Semiannual Status Report on NASA
Research Grant NsG - 135-61

Gentlemen:

This letter constitutes the twelfth semiannual status report of the Airglow research under NASA Grant NsG-135-61. The report covers the period 1 April 1967 to 31 March 1968.

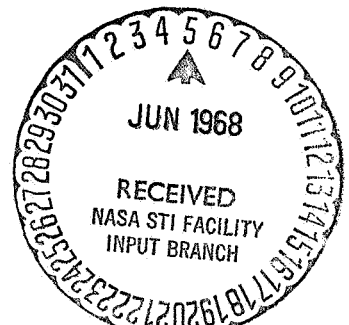
Observations:

Five separate photometers are observing the night airglow at the Haleakala observing site during each clear night between the last quarter and first quarter of the dark moon. The table shows these instruments and the wavelengths being observed.

The instruments labeled TT are fixed photometers with filter wheels permitting successive observations in four different wavelength regions. TT 1 is directed towards the zenith, TT 2 towards the ionosphere at a point where it is intersected at 250 km by the line joining Syncom III and a radio receiver on the University campus. TT 3 is directed towards the zenith also but is for the purpose of studying OH emission contamination in the 6300A and 5890-96A observations.

The ST and GY instruments are scanning photometers. The ST employs very narrow band interference filters while the GY employs wider band interference filters combined with a birefringent filter.

FACILITY FORM 602	N68 86050	
	(ACCESSION NUMBER)	(THRU)
	4	NONE
	(PAGES)	(CODE)
	CI-#94744	
	(NASA CR OR TMX OR AD NUMBER)	(CATEGORY)



INSTRUMENT	TT 1	TT 2	TT 3	ST	GY
WAVELENGTH, A					
5300	X	X			
5577	X	X		X	X
5890-96	X			X	X
6080		X	X		
6300	X	X	X	X	X
7150			X		
7300			X		
8200				0	
8400				0	

X - present

0 - planned

Current Studies:

The observations obtained with TT 2 mentioned above are being studied in connection with the total electron content of the ionosphere as determined by Faraday rotation of the signal transmitted from Syncom III and received at the University. The data from a number of nights have been analyzed in detail. One of these is reported by Brown and Steiger (see Publications) in Nature. It is found that, at least in those cases studied, the well-known tropical enhancements in 6300A emission are associated with increases in the total electron content. Furthermore, it is shown that the airglow emission rate is closely related to the negative time rate of change of content.

The question then becomes that of determining the source of the increase in electron content during the night-time. A night-time ionizing agent has been ruled out and we are now considering the possibility of accounting for these increases in content by a piling up of ionization due to a differential drift of ionization resulting from electric fields in the F-region ionosphere. According to H. Maeda these electric fields are transmitted to the F-region ionosphere from the E-region ionosphere where

they are generated by the dynamo action of tidal motions. A paper, now in press, by Roach, Brown, and Steiger sets forth these ideas.

It appears that these empirical ideas must now be assimilated into a theory of the formation of the night-time F-region of the ionosphere. To accomplish this, Brown is studying the continuity equation in the F-region:

$$\frac{\partial N_e}{\partial t} = L(h) - \frac{\partial}{\partial h} (N_e W_D) - \frac{\partial}{\partial h} (N_e W_e)$$

where N_e = electron density,

$L(h)$ = loss of ionization due to recombination, some of which results in 6300A airglow,

and the last two terms are divergence terms, the first resulting from an electrodynamic drift velocity and the second from a gravitational and diffusion velocity. Brown is now able to determine the electron profile and various parameters of the F-region ionosphere and also the integrated 6300A emission as a function of time during the night for various kinds of initial conditions. He is now engaged in finding the effect of electrodynamic drifts of various kinds on the F-region ionosphere and airglow.

Staff:

There have been no changes in the staff since the last report. The chief observer is Mr. Alex Kowalski (his salary is not derived from this grant), and he is assisted by Mr. Tomeo Kametani and Mr. Henry Heeseman. At the University campus Mrs. Livian Ogura and Mrs. Darlene Dung Leong are research assistants. The latter is leaving the program at the end of the current period (March 31, 1968).

Graduate student Walter Brown is participating in the program as part of his doctoral research.

Dr. Franklin E. Roach served as a consultant with the program from January 1 to March 31, 1968.

Publications:

1. W. R. Steiger, "Astronomy in the Hawaiian Islands," The Astronomical Herald (Japan) 60, 126-128 (1967) (in Japanese).
2. Brown, W. E., and W. R. Steiger, "Ionospheric Electron Content and the [OI] 6300A Nightglow," Nature 216, 47 (Oct. 7, 1967).
3. Smith, L. L., and W. R. Steiger, "Night Airglow Intensity Variations in the [OI] 5577A, [OI] 6300A, and NaI 5890-96A Emission Lines," J.G.R. 73, 2531-2538 (April 1968).

4. M. Huruata, W. R. Steiger, "A rocket observation of [OI] 5577A emission and continuum at 5300A in night airglow," Rep. Ionos. Space Res. Jap., in press.

5. F. E. Roach, W. E. Brown, W. R. Steiger, "F-region nightglow and electromagnetic drifts," Planet. Space Sci. in press.

Respectfully submitted,

Walter Brown for W. R. Steiger
Walter R. Steiger
Principal Investigator

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